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ORIGINAL ARTICLE

HEMODYNAMIC PARAMETERS AND BRAIN OXYGENATION IN MILITARY PILOTS AS A FUNCTION OF ACCELERATION'S DURATION AT 4G AND AT 6G: A PRELIMINARY STUDY

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Introduction: Rapid onset and prolonged/sustained accelerations are often encountered in military aviation. The centrifugal force causes blood mass volume displacements. The pilot counters this phenomenon by means of anti-G straining manoeuvres (AGSM). However, the physiology of such prolonged manoeuvres is not clear. Here we have evaluated the effects of 4G and 6G accelerations lasting 10s from 1.41Gz baseline on stroke volume (SV) and cardiac output (CO) and data quality, as well as changes in frontal brain oxygenation (OX) as a function of duration of the acceleration. We further compared the pilots' physiological responses to 4G and 6G.

Methods: Ten military pilots (six active, with various amount of flight experience) performed the rapid onset rate (ROR) profile characterized by rapid onsets of Gz to 4G and 6G that lasted for 10 seconds, each without Anti-G trousers. The pilots' SV, CO were evaluated with bioimpedance cardiography, while their OX - with near infrared spectroscopy. ECG was constantly monitored.

Figures: 10 • **Tables:** 1 • **References:** 14 • **Full-text PDF:** http://www.pjambp.com • **Copyright** © 2017 Polish Aviation Medicine Society, ul. Krasińskiego 54/56, 01-755 Warsaw, license WIML • **Indexation:** Index Copernicus, Polish Ministry of Science and Higher Education

Results: SV and CO were generally decreasing with time, whereas HR was increasing. On average, SV was not different between 4G and 6G. However, CO and HR were significantly higher at 4G than at baseline ($p<0.02$), as well as they were higher at 6G than at 4G and baseline ($p<0.005$). Despite that OX on average was lower at 6G than at 4G than at baseline ($p<0.03$). The data was of poorer quality and less of them were included in the numerical analyses for 6G than for 4G, most likely due to the performed AGSM.

Discussion: Rapid onset acceleration leads to physiological adaptations that are more pronounced at 6G than at 4G. There is some variability in the results due to the use of AGSM, which has a degrading effect on data quality.

Keywords: Hemodynamics, bioimpedance cardiography, +Gz, monitoring, brain oxygenation

INTRODUCTION

We have previously evaluated the effects of gradual onset of +Gz on stroke volume (SV), cardiac output (CO) using impedance cardiography, and oxygenation saturation (OX) of frontal lobe using near infrared spectroscopy (NIRS) [1]. Rapid onset, prolonged/sustained accelerations are often encountered in military aviation. The pilot counters the blood mass volume displacements by means of anti-G straining manoeuvres (AGSM). The 4G acceleration (without Anti-G trousers) in general does not require the use of AGSM, whereas 6G most certainly does. However, it is not clear how long lasting accelerations affect the pilots' physiology. Here we have evaluated the effects of 4G and 6G accelerations lasting 10s on SV, CO, and the quality of these measures, as well as changes in frontal brain oxygenation as a function of the duration of the acceleration.

METHODS

Subjects

Ten male military pilots (age: 34.8±8.2 years; 24-47 years), with various amount of flight experience participated in the study. All subjects held a current fitness to fly certificate issued by the Aeromedical Board (i.e., they were healthy). All of them had normal or corrected-to-normal vision. The study protocol was approved in advance by the Bioethical Committee of the Military Institute of Aviation Medicine in Warsaw (Decision no 04/2014). Each subject provided written informed consent before participating and they were compensated for taking part in the experiment.

Equipment

A human centrifuge HTC07 (AMST, Braunau, Austria) was used to produce the Gz. It was previously described in detail [1]. Mean blood oxygenation (both oxygenated and de-oxygenated blood) of the frontal lobe of the brain (OX) was measured using near infrared spectroscopy (NIRS; NellcorTM Pulse Oximetry, Covidien-Medtronic, Dublin, Ireland). OX was averaged in 4s intervals. The optoelectronic detector (optode) was attached to the right side of the forehead of the pilot. Stroke volume (SV) and cardiac output (CO) were measured using electrical bioimpedance. A 3-channel experimental module ReoWir (ITAM, Zabrze, Poland) was used to measure electrical bioimpedance simultaneously in the thorax and in the neck [1]. Metrological parameters of the module were verified by using a dedicated simulator of resistive parameters of the tissues – ReoTester [2].

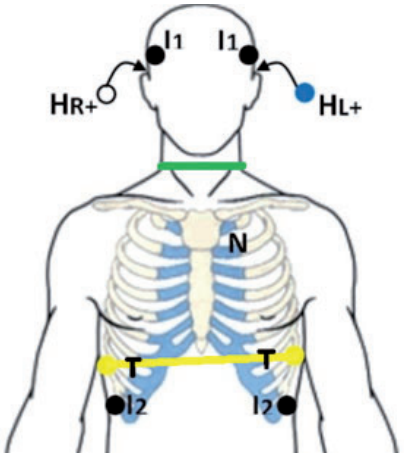

Fig. 1. Location of electrodes: Current electrodes: I1 placed on temples (gel electrodes), I2 placed on thorax (spring electrode), receiver electrodes Hl+ and HR+ - behind the ears (gel electrode), N placed on the bottom of the neck (stainless wire spring electrode).

The location of electrodes on the pilot is depicted in figure 1. The bioimpedance signal from the thorax is collected using a standard electrode

arrangement, as in Kubicek's method [3], but the location of the electrodes on the head is an original arrangement. Both NIRS and ReoWir were connected to the centrifuge system, thus the OX and bioimpedance signals were recorded synchronously with ECG, heart rate, Gz and saved in the centrifuge's data storing system. Then, all data were anonymized and exported for further processing on an external data processing station.

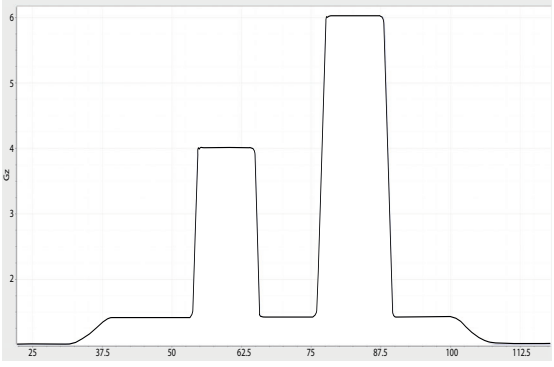

Fig. 2. Acceleration profile.

Procedure

The subjects were briefed on the study and its aims. Then ECG and bioimpedance leads were connected, and the NIRS optoelectronic detector was attached to the right side of the forehead. A Rapid Onset Rate (ROR) profile was selected, lasting 10 sec each.

Calculation of stroke volume

Stroke volume (SV) of the heart was calculated based on Kubicek's formula [4],

$$SV = constant\left(\frac{1}{Z_0}\right)^2 \left[LVET\left(\frac{dz}{dt}\right)_{max}\right]$$

where Z_0 is the base impedance measured directly during the experiment.

The Z_0 values measured at the beginning of LVET were used for calculations. The left-ventricular ejection time (LVET) and (dZ/dt)max were traced manually by two independent raters, trained and supervised by LP, who has extensive expertise in bioimpedance methods, as described previouisly [1]. Identified artefacts were excluded from analyses. SV and CO were calculated.

For the neck, only (dZ/dt)max was marked; it can be interpreted as the flow index in the carotid arteries [5,6]. The interclass correlation coefficient was higher than 0.7 for individual pilots. This result attests to good and very good reliability of the results. Similar results were obtained for CO calculated as SV·HR.

Statistical Analysis

The normality of distributions was evaluated automatically with appropriate tests. Student paired t-tests were utilized to evaluate the statistical significance of observed changes. We acknowledge that the bioimpedance signals were affected by artefacts created by the subject's breathing; however, these artefacts were added to the variability of measures obtained at particular conditions. All tests were performed with Statistica 13.1 software (Dell, Round Rock, TX, USA).

RESULTS

Fig. 3 – Fig. 10 illustrates the SV, CO, OX, and HR changes as a function of acceleration's duration at 4G and 6G. Interpersonal variability is likely due to the use of AGSM that visibly deteriorates the signal, making it near impossible to reliably trace it. AGSM is used more at 6G than at 4G, thus data for fewer pilots is available at the higher acceleration.

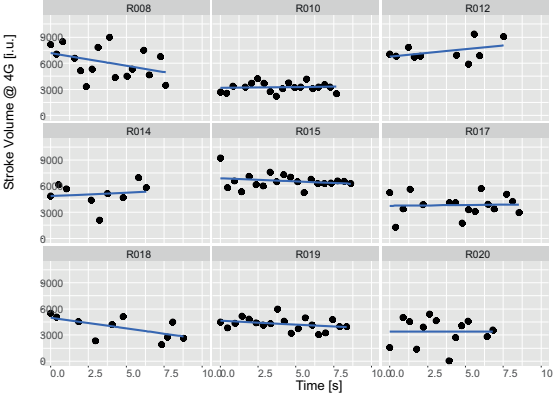

Fig. 3. Stroke volume changes with time at 4G. R008 – R020 indicate the consecutive pilots. Smaller numbers of measurements presented in some figures reflect lower quality of that data (need to exclude some measurements).

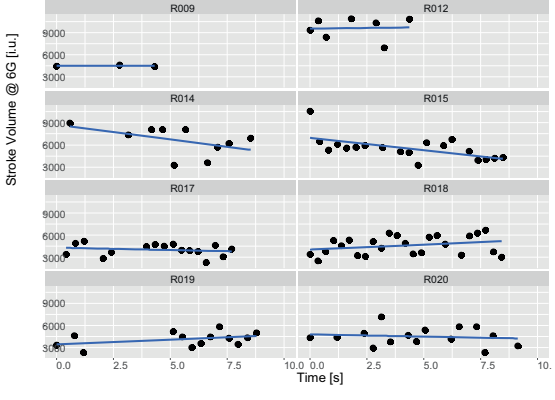

Fig. 4. Stroke volume changes with time at 6G. The lower number of data points (than at 4G) reflects poorer data quality. Please note that in some cases all data points had to be removed due to poor quality.

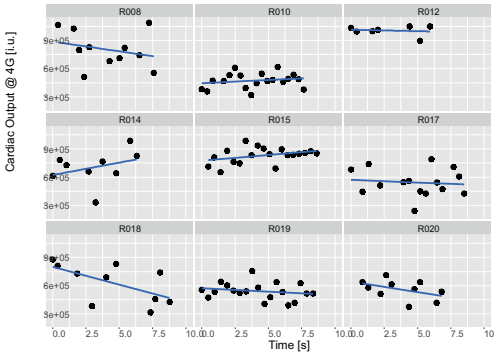

Fig. 5. Cardiac output changes with time at 4G.

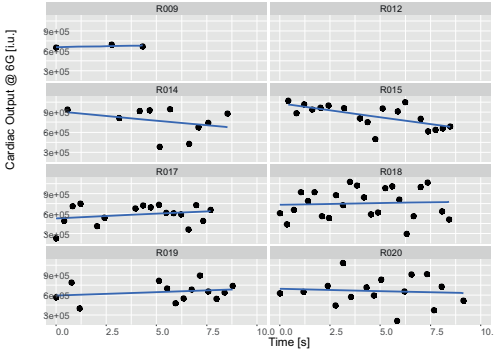

Fig. 6. Cardiac output changes with time at 6G.

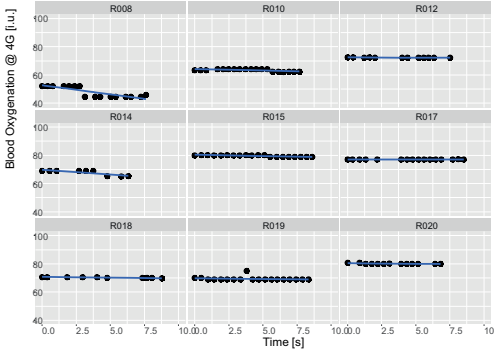

Fig. 7. Blood oxygenation (OX) changes with time at 4G.

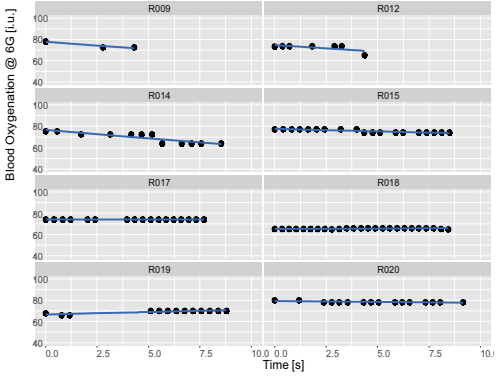

Fig. 8. Blood oxygenation (OX) changes with time at 6G.

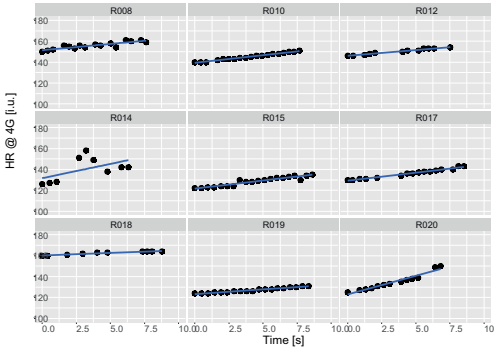

Fig. 9. Heart rate changes with time at 4G.

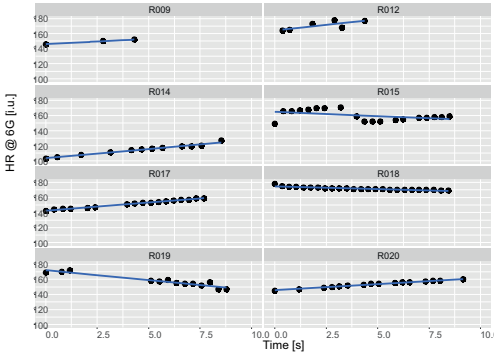

Fig. 10. Heart rate changes with time at 6G.

Table 1 shows the changes in mean SV, CO, OX, and HR between the baseline, 4G, and 6G.

Tab. 1. Changes in parameters induced by increases of accelerations; a) from baseline 1,4G to 4G, b) from 1,4G to 6G, c) from 4G to 6G.

Change in [%]	Change between [%], and significance level, p		
	Baseline and 4G	Baseline and 6G	4G and 6G
Stroke Volume (SV)	9±25, ns*	16±34, ns*	7±20, ns*
Cardiac Output (CO)	22±24, p=0.02	41±23, p=0.003	16±10, p=0.001
Heart Rate (HR)	14±12, p=0.001	26±14, p=0.005	9±14, p=005
Blood Oxygenation (OX)	-1±2, p=0.03	-4±3, p=0.003	-2±3, p=0.04
Flow Index	-12±34, ns	12±39, ns	21±34, ns

*ns - stastistically non significant.

DISCUSSION

In this study, we have demonstrated that the physiological response to rapid onset accelerations changes with time. However, the picture is distorted by the use of AGSM. Higher value of the acceleration leads to larger mean changes in stroke volume, cardiac output, brain oxygenation and heart rate. No significant changes in flow index were found.

However, larger G loads resulted in statistically significant decreases of brain frontal lobe oxygenation, most likely due to redistribution of the blood in the thorax; i.e. less blood ended up in the brain due to a larger gravitational field in the centrifuge. The additional +Gz effect that must be taken into consideration is air-blood mismatch in lungs under Gz [7-9].

All examined pilots were neither instructed to perform or withdraw from performing AGSM. However they performed the muscular component of AGSM without the breathing component. The breathing component of AGSM relies on intermittent increase of airway pressure which can at least partially alleviate Gz effects on the lungs. Rohdin et al. [10] also demonstrated decreased lung diffusion capacity in hypergravity. On the other hand, increases in base impedance of the neck with increasing Gz could be interpreted as decrease of the blood volume in the neck. However, the cranium acts as a rigid container of the brain, the cerebro-spinal fluid, and blood, which are virtually incompressible [11], thus the amount of blood in the brain is likely constant during the +Gz accelerations used in our study. Moreover, the cerebral autoregulation maintains a relatively constant cerebral blood flow within the range arterial blood pressure from about 60 to 150 mmHg [11,12]. In our experience, arterial blood pressure may decrease below 60 mmHg at +6G, thus smaller cerebral blood flow may contribute to decreases of OX with increasing +Gz.

Another thing worth consideration is venous return from brain. Under the +Gz load, blood tends to be pooled in the venous system of the lower extremities and the lower part of the abdomen. This othostatic effect may cause blood pressure in jugular veins to be lowered to almost zero, which may cause jugular veins to collapse and effectively stop the venous outflow from the brain. Some portions of blood "trapped" in parts of the brain may be further deoxygenated through the metabolism of the surrounding tissues, which can contribute to a decrease in the Ox results registered.

The above mentioned phenomena could be responsible for the small drop in brain oxygenation in our participants, despite significantly larger cardiac outputs at 6G than at 4G.

We did not evaluate changes in arterial pressure and its relationship to the measured parameters. As it is known that Z0 increases with bleeding induced hypotension in pigs [13], it is likely that changes in blood pressure would explain some variance in SV, CO, and OX.

Our results may help understand the physiological adaptations to hypergravity in commercial space flights, where the accelerations do not exceed 6G and the age of the prospective space travellers spans a wide range from 22 to 80 years [14]. Although the G loads in these voyages are not expected to exceed 4G, one should remember that military pilots are selected based on endurance and fitness. Thus, the physiological processes described in our study may take place at much lower accelerations in the general population. The non-zero resistance of the current electrodes applied in our study led to some limitations in the results, as it caused a slight overestimation of baseline impedances, but, it resulted in a slight underestimation of the reported changes in SV and CO. Similarly, the breathing artefacts had detrimental effects on fitting quality; however, it is unlikely it biased the regression results.

The conclusions are limited by the fact that the pilots performed straining at the onset of the acceleration and at various times of the overload.

CONCLUSIONS

Rapid onset acceleration led to physiological adaptations that are more pronounced at 6G than at 4G. There is some variability in the results due to the use of AGSM that has a degrading effect on data quality.

AUTHORS' DECLARATION:

Study Design: Krzysztof Kowalczuk, Liana Puchalska, Mariusz Wyleżoł, Stefan P. Gaździński; **Data Collection and Analysis:** Krzysztof Kowalczuk, Liana Puchalska, Hanna Palonek, Aleksander Sobotnicki, Michał Janewicz, Stefan P. Gaździński; **Manuscript Preparation:** Stefan P. Gaździński, Krzysztof Kowalczuk; **Funds Collection:** Mariusz Wyleżoł. The Authors declare that there is no conflict of interest.

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DOI: 10.13174/pjambp.16.07.2018.02

ORIGINAL ARTICLE

SENSE OF CONTROL, SATISFACTION WITH LIFE AND STRESS COPING STYLES OF FLIGHT STAFF

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Source of support: Own sources

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Introduction: The aim of this study is to examine the relationship between the sense of control, life satisfaction and stress coping styles, and whether there are any differences between air traffic controllers and pilots in these variables.

Methods: 80 men were tested, including 40 military pilots and 40 air traffic controllers. The tests were carried out with the use of: Satisfaction with Life Scale (SWLS/) - authors: Ed Diener, Robert A. Emmons, Randy J. Larson, Sharon Griffin, *the Survey* for Measurement of the Sense of Control /*Delta*/- by *R*. Ł. *Drwal*, The Coping Inventory for Stressful Situations /CISS/ - by N. S. Endler, J.D.A. Parker.

Results: On the basis of statistical analyses, no differences were found between pilots and air traffic controllers in the sense of location of control. Compared to air traffic controllers, pilots achieve significantly higher results in the case of the avoidance style and its sub-dimensions, i.e. surrogate activities and looking for social contacts as a form of coping with stress. In addition, the group of pilots found a significant positive relationship between life satisfaction and the search for social contacts, while the group of controllers found a significant moderate negative relationship between life satisfaction and the emotional stress coping style.

Keywords: stress coping styles, sense of control, life satisfaction, air traffic controllers, pilots

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INTRODUCTION

Occupations associated with aviation involve responsibility for one's health and life and that of others both in the air and on the ground, as is the case in the event of an accident or catastrophe. Therefore, in order to ensure maximum safety of air missions, as early as in 1928 obligatory medical and psychological examinations of candidates for aviation were introduced in our country.

The assessment of the psychophysical fitness of aviation applicants shall be carried out by specialist aviation medicine committees composed of certified aviation medicine examiners and specialized psychologists. These specialists assess the suitability for a specific type of aviation or for specific jobs in aviation on the basis of subjective, objective, laboratory tests.

In order to monitor the health status of aviation personnel throughout their working lives, mandatory annual tests before an aviation medicine commission have also been introduced. In the case of health or professional problems, aviation personnel are referred to the aviation medicine committee for occasional examinations, the purpose of which is to find the reasons (health, psychological) for ineffective performance of tasks and to determine their current suitability for work in occupations associated with aviation.

In addition, the development of aviation technology and the increasing number of air operations are resulting in an increasing psychophysical burden in occupations associated with aviation. This is reflected in the dynamics of everyday life in society and generates stressful situations which, in order to ensure flight safety, require exploratory research in order to ensure efficiency and reliability in the performance of aviation tasks.

The knowledge gained from the conducted tests allows to improve diagnostic methods in such a way that it is possible to assess more accurately the professional predispositions of the aviation personnel and to forecast the operator reliability of pilots (flight crews) and air traffic controllers [1,7,16].

As already mentioned, the working conditions in occupations associated with aviation can be considered as stressful situations (occupational stress), which sometimes also involves the need to act in non-standard situations, which may burden the human being both mentally and physically [16]. In the literature [12] on the subject, such situations are well explained, among others, by R. Lazarus's and S. Folkman's transactional concept of stress. These authors describe stress as "a special kind of relationship between humans and their environment, which they consider to be taxing or exceeding their resources and endangering his well-being" [12]. Stress situations encountered by people are usually triggered by activities aimed at improving ill emotional health and restoring a balance between the requirements and the possibilities of meeting them. Whereas the set of strategies, or dispositions, that are activated in a given stress situation, is defined as a style of coping with stress, and these are "constantly changing cognitive and behavioral efforts to manage specific external and internal requirements, assessed by a person as taxing or exceeding their resources" [8,9,15]. Therefore, coping with stress can be assigned with two functions. The first one is problem-oriented, focusing on improving relations between the entity and its environment, and is described as task-based. The second is the function of self-regulation of emotions, which consists in lowering unpleasant tension and alleviating other negative emotional states. The two functions or the trends of coping are not entirely separate and independent. In a specific stress situation, they interweave and interact with each other.

The authors of many studies [12,13,15,16,17] also draw attention to the role of emotions in the process of coping with problems, which also play an important adaptational role. Namely, they indicate that something vital for the subject is going on, and also they energize the process of coping and shape its course. Therefore, self-regulation of emotions may reduce unpleasant tension, but it may also aim at increasing the mobilizing stimulus for action [8,9]. Referring to this concept, Endler and Parker [6] proposed three styles of stress management. In addition to the task- and emotion-focused styles proposed by Lazarus and Folkman [12], they propose a third way of dealing with stress, i.e. focusing on avoiding it. It is characterized by a tendency to avoid, survive and think about the risk in order to reduce the effects of the stressor [13]. The choice of the style of coping with stress depends on both the situation perceived as difficult and individual properties of a human being [8,9]. Amongst them one can list a variable of personality, which is the "location of the sense of control". Julian Rotter's "location of the sense of control" construct was presented in his work on social learning theory as a dimension of personality [8] and is expressed as a general expectation that one's own action is a tool to achieve one's goal. When experiencing reality, the human being influences the environment, anticipates its states and gradually creates in their cognitive system

a picture of the basic relationship between themselves and their surroundings. The set of beliefs that makes up this image is called the sense of control [11]. In this way, a person develops a permanent, generalized expectation for the location of reinforcement control. It is an individual property of a human being which is perceived as a dimension of personality, a continuum with two opposite poles: a generalized sense of external control and a generalized sense of internal control [4,5]. If a person perceives an event as a consequence of their own actions, makes efforts to control their environment, takes responsibility for their own actions, searches for information, then this is the so-called sense of internal control. However, when they perceive events as the result of: chance, luck, destiny, we are dealing with a sense of external control [12].

Human stress is also related to life satisfaction, which affects professional efficiency. Stress may lead to the improvement of individual quality of life or reduce it, however, it depends on the subjective assessment of its intensity [12].

Ineffective performance of work, mistakes made, negative evaluation of professional activities result in a significant drop in satisfaction with life, causing insecurity and a lack of emotional stability.

The multiplicity of stressful effects of the working environment of pilots and air traffic controllers cannot be without consequences for physical or mental health. In this context, the problem of the satisfaction with life experienced by such professional groups is of particular importance. It is described in the literature on the subject as an overall assessment of satisfaction with one's own achievements and living conditions [3,10]. Such an understanding of life satisfaction refers to subjective indicators, i.e. the assessments of the person themselves, and not to objective indicators of the quality of life, and also includes them as cognitive assessment, evaluating judgment, and not an emotional condition.

The research also indicates that work may influence the satisfaction with its performance, when it is a source of pleasure, good interpersonal relations and serves to build a sense of meaningfulness in life [14].

These factors seem to be an area of research on the working environment of such specific occupational groups as pilots and air traffic controllers in terms of cognition and application, because of the high social responsibility for the fate of other people.

It should be stressed that the ineffective performance of the tasks of these professional groups can lead to air accidents or catastrophes, and that this has consequences both in terms of the media and in terms of personal and economic well-being.

The literature on psychological studies in the professional group of pilots and air traffic controllers is not very extensive. So far, no research has been carried out into the interrelationships between such variables as: the sense of control or satisfaction with life and the styles of coping with stressful situations in the above mentioned professional groups.

Many studies analyzing the relationship between stress management styles and personality can be found in Polish literature [2,9,12,15,16,17]. Numerous studies have been carried out over a period of several years, but with different testing methods. Moreover, it was not possible to find works in the available literature that would deal with the issues of control, satisfaction with life and styles of coping with work stress. The current work is exploratory in nature, and the results and analysis of the obtained results can be treated as a basis for further research.

The aim of this study is to examine the relationship between the sense of control, life satisfaction and stress coping styles, and whether there are any differences between air traffic controllers and pilots in these variables. Therefore, the aim of this paper is to answer the following research questions:

1. Are there differences between pilots and air traffic controllers in the sense of where control is located, in the way they deal with stress and in their sense of satisfaction with life?
2. Are there relationships between the sense of location of control and stress coping styles?
3. Are there any links between the sense of location of control and satisfaction with life?
4. Are there any links between life satisfaction and stress coping styles?

METHODS

80 people aged 23 to 41 were tested. This group consisted of 40 pilots and 40 air traffic controllers. The research took place at the Military Institute of Aviation Medicine and at the Polish Air Navigation Services Agency. Participation in the study was anonymous and voluntary. In the groups of pilots and controllers there is a similar number of persons with secondary and tertiary education.

The following research tools were used in the studies:

1. The Survey for Measurement of the Sense of Control /Delta/ - by Radosław Ł. Drwal [4].
2. Satisfaction with Life Scale (SWLS) - authors: Ed Diener, Robert A. Emmons, Randy J. Larson, Sharon Griffin (Polish adaptation by Z. Juczyński) [10].
3. The Coping Inventory for Stressful Situations (CISS) - authors: N. S. Endler, J. D. A. Parker (Polish adaptation by P. Szczepaniak, J. Strelau and K. Wrześniewski) [6].

RESULTS

In order to verify the differences between the pilots and the controllers in the sense of location of control /Delta/, a comparison of the averages between the examined groups was made. Due to the fact that the variables describing the location of control and the lie scale in the Delta test did not have a normal distribution, the analysis was carried out using a nonparametric Mann-Whitney U-rank test[1]. Belonging to the above mentioned occupational groups was introduced as a grouping variable, while the analyzed variables included the sense of location of control and results in the lie scale. The obtained data have been presented in table 1.

Tab. 1. Comparison of the location of control between pilots and air traffic controllers.

Parameter	Group of professionals	Average ranks (Rs)	(Sd)	Z	n	Significance (bilateral)
Location of control	Pilots	3.13	2.45	-0.990	40	0.322
	Controllers	3.48	2.12		40	
Lie Scale	Pilots	2.20	1.52	-1.003	40	0.316
	Controllers	1.85	1.35		40	

Legend: Z - test statistics, Sd - standard deviation, Rs - average ranks, n - number of people tested

On the basis of the Mann-Whitney U test, the differences on the "sense of location of control" scale between the flight controllers and the pilots proved to be statistically insignificant Z = -0.090, p = 0.322.

One then also sought to determine whether the pilots differed from the air traffic controllers in the severity of the specific "styles and stress management" used (table 2) and the perceived "satisfaction with life" (table 3). For this purpose, a comparison of the averages between the two groups of the Student's t-test for two independent groups was made.

Tab. 2. Comparison of stress management styles between a group of tested pilots and air traffic controllers.

Management style	Group of professionals	(M)	(Sd)	t	Df	Significance (bilateral)
Task-oriented	Pilots	58.10	7.87	**-2.194**	**78**	**0.031**
	Controllers	61.95	7.83			
Emotional	Pilots	35.10	9.85	0.674	78	0.502
	Controllers	33.68	9.05			
Avoidance	Pilots	45.75	9.19	**4.138**	**78**	**0.001**
	Controllers	36.73	10.29			
Surrogate activities	Pilots	19.80	5.47	**3.789**	**78**	**0.001**
	Controllers	14.63	6.69			
Social contacts	Pilots	17.08	3.69	**2.923**	**78**	**0.005**
	Controllers	14.80	3.26			

Legend: M - arithmetic average, t - test statistics, Sd - standard deviation, Df - degrees offreedom

The result of the conducted analysis turned out to be politically significant t(78)=-2.194; p=0.031 between the groups examined in relation to the task-oriented style. In this respect, air traffic controllers achieved significantly higher results (M=61.95), while persons from the group of pilots (M=58.10) had lower results. Also the groups studied differed significantly in terms of statistics on the use of the "avoidance style". [t(78)=4.138; p<0.001] and its subdimensions, i.e. "surrogate activities" [t(78)=3.798; p<0.001] and "seeking social contacts" [t(78)=2.923; p=0.005]. The results shown in Table 2 show that pilots achieved significantly higher values than air traffic controllers in this dimension. The assessment of satisfaction with life is in turn presented in table 3.

Tab. 3. Comparison of the level of satisfaction with life between professional groups.

Parameter	Group of professionals	Mean (M)	Standard deviation (Sd)	t	Df	Significance (bilateral)
Satisfaction with life	Pilots	24.35	4.46	1.098	78	0.276
	Controllers	23.30	4.08			

Legend: M - arithmetic average, t - test statistics, Sd - standard deviation, Df - degrees offreedom

Both occupational groups indicated a similar level of satisfaction with life. For the pilots the average satisfaction was M = 24.35, Sd = 4.46, for the controllers M = 23.30; Sd = 4.08.

A correlation analysis has been carried out to see if there is a relationship between the sense of location of control and stress management styles. Due to the fact that the variable describing the sense of location of control did not get a normal

1 The Mann-Whitney U test is used when you want to compare two independent samples. It is considered to be the non-parametric equivalent of the Student's parametric t-test for independent samples.

distribution, the analysis used the non-parametric Spearman's rho rank correlation coefficient. The analysis was conducted for both groups together and separately for the group of pilots and the air traffic controllers. The analysis results are presented in table 4.

Tab. 4. Relationships between the sense of location of control and stress coping styles.

Management style	Parameter	Group of professionals		
		Total	Pilots	Controllers
Task-oriented	Correlation coefficient	**-0.356**	**-0.554**	-0.247
	Significance (bilateral)	**0.001**	**0.001**	0.125
Emotional	Correlation coefficient	0.188	0.133	0.169
	Significance (bilateral)	0.095	0.415	0.297
Avoidance	Correlation coefficient	0.151	0.115	0.222
	Significance (bilateral)	0.182	0.481	0.168
Surrogate activities	Correlation coefficient	0.169	0.116	0.219
	Significance (bilateral)	0.133	0.475	0.175
Social contacts	Correlation coefficient	0.024	0.071	0.129
	Significance (bilateral)	0.834	0.664	0.427

On the basis of the conducted analysis, a significant negative moderate relationship between the "sense of location of control" and the "task-oriented stress management style" was found in the group of pilots.

Next, the relationships between the "location of control" and "satisfaction with life" were analyzed. As before, the analysis was conducted for both groups together and separately for the group of pilots and the air traffic controllers. The analysis results are presented in table 5.

Tab. 5. Relationships between the sense of location of control and satisfaction with life.

Parameter		Group of professionals		
		Total	Pilots	Controllers
Satisfaction with life	Correlation coefficient	-0.019	-0.175	-0.080
	Significance (bilateral)	0.868	0.279	0.623
	Number of research subjects	80	40	40

The results of the research indicate that there were no statistically significant relationships between the "sense of location of control" and "satisfaction from life" in the groups we studied.

The linear Pearson r correlation coefficient was used to check the relationship between "satisfaction with life" and "stress management styles".

Tab. 6. Relationships between life satisfaction and stress coping styles.

Management style	Parameter	Group of professionals		
		Total	Pilots	Controllers
Task-oriented	Pearson's correlation	0.037	0.114	0.020
	Significance (bilateral)	0.748	0.485	0.904
Emotional	Pearson's correlation	**-0.308**	-0.231	**-0.427**
	Significance (bilateral)	**0.006**	0.152	**0.006**
Avoidance	Pearson's correlation	0.015	0.136	-0.216
	Significance (bilateral)	0.897	0.403	0.181
Surrogate activities	Pearson's correlation	-0.058	0.026	-0.247
	Significance (bilateral)	0.608	0.873	0.124
Social contacts	Pearson's correlation	0.179	**0.327**	-0.070
	Significance (bilateral)	0.111	**0.040**	0.666

In the group of pilots there was a significant positive weak relationship between "satisfaction with life" and "seeking for social contacts". On the other hand, the group of controllers had a significant negative moderate relationship between "satisfaction with life" and "emotional stress management style". The above table also shows that no statistically significant correlations with satisfaction with life in the studied groups of professional pilots and air traffic controllers were found with respect to the task-oriented and avoidance styles, as well as with respect to surrogate activities.

DISCUSSION

The studies show that there are no differences between the pilots and the air traffic controllers in the sense of location of control. It should be stressed that the groups were similar in terms of variables such as age, gender and education. The lack of differences in intensity of this characteristic may indicate homogeneity of the studied groups and similarity of professional burdens in both pilots and air traffic controllers. This leads to the conclusion that both professional groups perceive their own behavior and what is happening in their professional environment as dependent on them and not on chance or on other people. According to the literature, an internal sense of control [16] is the most conducive to efficient operation and taking up challenges. Thus, it is a desirable personality trait for both pilots and air traffic controllers. Namely, by being convinced that they have an impact on their own lives, people with such

characteristics can take dynamic, independent and effective action, especially in stressful situations, and they can be very active in searching for information, using their previously acquired knowledge to solve problems.

The results of analyses of the above mentioned professional groups, which refer to preferred styles of coping with stress (i.e. task-oriented and avoidance-oriented), significantly differentiate these groups in statistical terms. Thus, in relation to the avoidance style and its subdimensions, i.e. surrogate activities and seeking social contacts, as a form of coping with stress, the group of pilots achieved significantly higher results in comparison with the group of air traffic controllers. On the other hand, no significant statistical dependencies were found in the compared professional groups in terms of preference for the emotional style of coping with stress.

The analysis also showed differences between the two groups in their preference for the avoidance-oriented style and its subdimensions in terms of seeking social contacts and engaging in surrogate activities. In these dimensions, the pilots score significantly higher than the air traffic controllers. It is likely that, although they manage stressful situations such as the pilot profession efficiently, they tend to avoid thinking, re-living and repeatedly experiencing difficult situations. They have to solve problems they may encounter in the air on an ongoing basis and additionally have in mind the responsibility they bear for the safety of passengers with whom they fly. The avoidance style of coping with stress in this case may play an adapational role in solving short-term problems than in the case of chronic stress [12].

On the other hand, the comparison of pilots with air traffic controllers in terms of perceived life satisfaction did not indicate any significant statistical differences between them. It can be deduced from this that two groups so similar in professional terms may feel a similar level of satisfaction with life. As the previous analysis of the variables has shown, the difference in average results between the two groups is minimal, which may be related, among other things, to the similarity of their choice of a profession related to aviation and a common five-year educational and pedagogical path at an aviation college.

The next step was to identify the relationships that may exist in the sense of location of control with the choice of preferred stress management styles. The results showed that there is a significant negative relationship between the sense of location of control and the stress management style of the pilots. This means that the higher the results of the pilots regarding the external sense of control, the less the task-oriented stress management style is preferred. The study did not establish a link between the sense of location of control and the choice of other stress management styles. People with an internal sense of control over reinforcements in the face of threatening situations make an effort to solve the situation constructively, rather than to focus on their own emotions and experiences. The internal sense of control of reinforcement is connected with the belief in their own ability to control everyday situations and with high self-esteem, which can be useful when practicing such a dangerous profession. The literature [16] indicates that perceiving one's own control over events experienced in life remains a coincidence with better mental well-being. People looking for factors that shape their fate outside themselves, cope with stress much worse than those who claim to be the authors of events [2]. The internal subjective belief of a human being that they can control their difficulties makes them treat a given situation as a challenge, which involves taking more efficient action to reduce the negative tension caused by stress.

On the other hand, the lack of links between the sense of control and other stress management styles may indicate that coping with difficult situations may be determined by situational factors rather than personality factors.

On the basis of the conducted research, it was not possible to determine the relationship between the sense of location of control and the perceived satisfaction with life. This could mean that the location of control may not affect the subjectively perceived satisfaction with life in the analyzed groups.

Effective management of stress is one of the indicators of satisfaction with life, according to research. The analysis of the obtained dependencies revealed a statistically significant weak positive relationship between the satisfaction with life and seeking social contacts in the pilots. The air traffic controllers have been shown to have a significant negative moderate relationship between satisfaction with life and the emotional stress management style.

The higher the scores of the pilots in the perceived satisfaction with life, the higher the score in the social contacts scale as an avoidance stress management style. For the air traffic controllers, however, the results show that the higher their results are on the satisfaction scale, the lower is their score in the emotional stress management style.

One of the factors from which people gain satisfaction is their own activity and contacts with other people. Close relationships with others, belonging to a group can help to overcome stressful events and thus effectively contribute to an increase in the quality of life. Through contacts with others, pilots can try to reduce emotional states, analyze the stressful situations in which they may find themselves, and obtain social support for their actions. Such strategies may have a mobilizing function and direct the course of remedial action [12].

Faced with stressful situations, air traffic controllers focus on actions aiming at addressing the problem by changing the situation or by cognitively transforming it. The solution of problems reduces negative emotions and contributes to sensing positive emotions, which can become a source of a sense of satisfaction with life. As the theory of building and broadening positive emotions says, experiencing positive emotions increases creativity and the ability to think, which is the reason for choosing more effective strategies for dealing with stress [12].

The research carried out has made it possible, to some extent, to characterize specific professional groups, such as pilots and air traffic controllers. Moreover, the results were used to determine whether there are relationships between such variables as: the sense of control, satisfaction with life and the styles of coping with stress. The results presented above and the conclusions may serve as an inspiration to undertake further research in order to characterize such specific occupations, which are considered to be one of the most responsible and stressful.

CONCLUSIONS

No statistically significant differences were found between the pilots and the air traffic controllers in the sense of location of control.

Pilots achieve slightly higher results in the case of applying the avoidance style and its subdimensions, i.e. surrogate activities and looking for social contacts as a form of coping with stress.

There were no significant statistical differences between the two groups in terms of satisfaction with life.

There was a significant positive weak relationship between "satisfaction with life" and "seeking for social contacts" in the pilots.

The group of controllers had a significant negative moderate relationship between "satisfaction with life" and "emotional stress management style".

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REVIEW ARTICLE

THE POTENTIAL EFFICACY OF AN AVIATION BIOTERRORIST ATTACK AND ITS PSYCHOSOCIAL CONSEQUENCES

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Abstract: The work concerns the analysis of the possibility of a bioterrorist attack using infected material using modern air transport carriers to infect the human population. It is possible to use passenger and transport planes, but the use of drones and minidrones seems the most dangerous. A bioterrorist attack is very specific and differs from other forms of terrorism, first of all in the possibility of self-replication of the pathogen, as well as the ability to "sleep" its operation even for many years and completely unexpectedly activate it. In such conditions, not only fast medical neutralizing action becomes crucial, but also calming psychosocial reactions and reasonable cooperation of the authorities and the media.

Keywords: air bioterrorism, aircraft as a weapon, drones attack, infected passengers, psychosocial reaction, unexplained psychosomatic symptoms, post traumatic stress disorder (PTSD)

Tables: 1 • **References:** 49 • **Full-text PDF:** http://www.pjambp.com • **Copyright** © 2017 Polish Aviation Medicine Society, ul. Krasińskiego 54/56, 01-755 Warsaw, license WIML • **Indexation:** Index Copernicus, Polish Ministry of Science and Higher Education

INTRODUCTION

The fast development of a genetic engineering has meant that should led to the serious consideration and political talks should be given mostly to because of the possibility of transforming biological viruses into lethal leathal weapons, whose deliberate proliferation may lead to pandemic and deadly threat to the entire social groups. Conventional weapons produce immediate effects and have a direct impact on human health, while biological agents have prolonged consequences and will build future threats that can not be easily estimated [34]. Health consequences caused by biological diseases such as smallpox, increases the potential risk of transmission from person to person, which is a great specification of a biological weapon. Most biological agents suitable for a terrorist attack are odorless and invisible to humans [42]. In this case, the treatment procedures caused by infections are not sufficiently effective and there is a risk of developing a disease after being exposed to the infection. An attack with the use of a biological weapons seems nowadays a quite likely alternative to the terrorist „conventional" methods used so far [12]. With the help of relatively small means, very spectacular effects can be achieved leading to the death or severe diseases of many people. In addition, the consequences will not be limited only to direct victims, because there are reasonable assumptions that they will also cause serious perturbations of a psychological, sociological, economical and political nature and what worse intensifies social anxiety and individual concern. Differences in a relation to the others methods of a terrorism (such as aircraft hijacking or bomb attack) are so important that it should be assumed that there will also be fundamentally different human reactions, primarily related to the difficulty of determining the true nature of the damaging factor, the possibility of its impact in the short and long perspective [18]. The Aum Shinrikyo's 1995 sarin attack on the Tokyo metro station had reminded the world that by using a very simple method it can destroy the efforts of maintaining peace. The World Trade Center towers cataclysm on September 11th 2001 immediately was followed by a bioterrorist attack. These attacks were calculated to involve maximal psychological casualties, involving uncertainty, fear, social distortion and the economic crises and international disturbances [49].

History of bioterrorism

In the long history of human conflicts different biological substances and the expert knowledge about infectious diseases were used not only for healing, but also for killing other people. The history of the use of a biological weapons has a centuries-old tradition. A couple of examples:

- in the sixth century BC, the Assyrians poisoned wells useding ergot rye to poison enemies wells [13],
- the Romans used poisoned arrows by, submerging them into dead bodies or animal excrements [3],
- the Tatars catapulted the dead bodies to the opponent's side. This attack forced Feodosia inhabitants to, as a result of which the inhabitants of Feodosia were forced to leave the city and escaped Genoa and Venice. In this way, the epidemic has been expanded [15],
- apparently, also Polish troops in 1650 used missiles contaminated by the saliva of rabid dogs [15],
- in 1797, the Napoleonic army flooded the plains around Mantua (Italy) to strengthen the spread of malaria among the enemy [15],
- in 1863, the Confederates handed over clothes from patients with yellow fever and smallpox soldiers to the Union Forces during the American Civil War [3].

Those examples were fierce and terrifying but were used on the small scale. The possibility of using a biological agent as a weapon of mass destruction is much worse and threatening, especially in the last century and now. However, it was only the twentieth and twenty-first century that posed a threat in the form of making biological weapons of mass destruction a biological agent. During World War I, the German soldiers tried to infect horses and mules with sugar cubes contaminated with anthrax bacteria contained in sugar cubes horses and mules [37]. World War II was also the arena where biological weapons were tested. Japan created a wax unit called Unit 731, located in Beiyinhe in Manchuria and carried out experiments with prisoners of war [1]. Christopher, Cieslak, Pavlin, Eitzen [8] reported that several thousand prisoners died as a result of their experiments. What's more, mortality among people living in the area of unit 731 was very high for the next few years. After the war in 1950, the Americans carried out an experiment to infect human populations around the Bay of San Francisco with the bacteria Serratia marcescens, a low-risk pathogen that infects the skin and the respiratory system. However, the effect was quite exceptional, because almost the entire population was infected and despite seemingly harmless operation,

several people were killed [9]. In the seventies of the XX century in the USSR research on biological weapons was conducted intensively. conducted. Pathogens such as tularemia, anthrax, glanders, chickenpox and encephalitis virus have been produced. In Sverdlovsk in 1979, as an effect of an accident, anthrax has penetrated laboratory walls. The epidemic occurred at a distance of 4 km from the research laboratory [1]. However, Soviet officials said it happened after eating contaminated meat, and it was not until 1992 that President Boris Yeltsin officially admitted that the epidemic was due to the waxy fault of these investigations experiments. This caused an anthrax epidemic that resulted in 77 morbidity and 66 deaths occurred within 28 days of the pathogen's release [29]. At present, we still do not exactly know what happened to the biological weapons stock in Russia.

Definition of terrorism and bioterrorism

Since attack on the World Trade Center in September 11th 2001, train bombings in London in March 11th 2004 and July 7th 2005 the term „the psychology of terror" increased it interest. All this resulted not only in fatalities and injuries of many people but also in the traumatic reactions of the whole societies. Crenshaw [11] believes that it is possible to talk about a new kind of terrorism which aims to transform the world based on primarily religious differences but also on a civilization and cultural changes. In this context the phrase global „strategy against terrorism" forced us to deal with global terrorism as opposition to the „old" terrorism which has a rather limited range and seek to obtain political support for their ideas. Above mentioned September 11th 2001 has became as a starting point for modern societies to prepare and planning a possible reaction to the use of a chemical, biological, radiological and, nuclear, (CBRN) weapons of mass destruction [44].

Defining terrorism is not only a theoretical issue but an operational necessity. Without answering the question of „what is terrorism" you can neither impose the responsibility on those countries that support terrorism or engage in state terrorism, nor can you take steps to combat terrorist organizations and their allies. Until now it had been built much more than 100 definitions of terrorism [27]. This proves that still not all aspects of this phenomenon are clear and comprehended.

The USA for example defined terrorism in accordance with the Federal Criminal Code, which defines terrorism as a means involving violent (...) or life-threatening activities [...] that violate the criminal law of the United States or any country and appears to be intended (i) to intimidate or coerce a civilian population; (ii) influence government policy through intimidation or coercion; or (iii) influence government behavior as a result of mass annihilation, homicide or kidnapping; and ... (C) occur primarily within the territorial jurisdiction of the United States ... " [46].

The definition of terrorism defined by Department of Defense (DOD) it is as "the unlawful use of violence or threat of violence to instill fear and coerce governments or societies. Terrorism is often motivated by religious, political, or other ideological beliefs and committed in the pursuit of goals that are usually political [22]. It should be noted that both of these deficits draw attention to the phenomenon of intimidation and the spread of fear throughout society or the terrorist act itself or only its announcement. Another definition concerning biological agents „The intentional release of an infectious particle such as a virus or a bacterium from the confines of a laboratory or medical practice must be formally condemned as an irresponsible threat against the whole human community" [26]. In this context bioterrorism can be defined as the intentional use of living organisms such as bacteria, viruses and fungi with the intent to cause disease, death, or environmental damage [5]. These agents are typically found in nature but it is possible that they could be changed to increase their ability to cause disease, make them resistant to current medicines or to increase their ability to be spread into the environment. Biological agents can be spread through the air, water or in the food. Bioterrorism has a potential and lethal method to threaten human individually or even nationwidenational wide. This intimidation may concern an unknown range of destructive influences of the pathogen on the human body and / or the threat of incurring attacks.

Differences between bioterrorism and other forms of terrorism

Infectious agents used in bioterrorist attacks have three features that make it very attractive in the hands of terrorists:

1. The pathogens replicate themselves, which means no more than they can reproduce and spread in the environment themselves [39].
2. Pathogens spread through people's contact with each other, making completely innocent people unwittingly "cooperate" with terrorists and become carriers of a lethal disease [39].
3. Dormant biological agents can go unnoticed for many years in the environment and appear unexpectedly [17].

The most important factor that differentiates bioterrorism from other forms of terrorism is that biological agents can be easily transferred from person to person. This means that far-reaching consequences are not easy to predict and can be much more harmful if you only consider an attack limited to one specific location. Bioterrorism is different from other types of terrorist methods, primarily a long-term impact on the population. The cruelty of biological weapons is based on uncertainty and the lack of clear targets, which causes difficulties in determining whether an attack has occurred and what its real extent is [20]. The worst case scenario that could be met in a bioterrorist attack is based on the assumption that you can unknowingly be the target of infection and later the carrier of an infectious substance. Biological weapons are therefore more fearsome terrorist than conventional war weapons, because there it is not only an intention tended to destroy a part of the population, but also used as a means to an end used to obtain a psychological impact on a much wider population - by introducing social anxieties, fear and violence. Human reactions can have a negative effect on others. One possible symptom is the possibility of panic behavior on a large scale. In such circumstances, lack of information and uncertainty about the psychological effects of bioterrorism complicate the task of a responsible preparation and proper response in the event of an attack. Clear understanding of how to deal with the psychological effects of a bioterrorism is crucial to the development and implementation of a realistic preventions [2]. At the same time, it is important to consider how to implement and communicate the plans to reduce anxiety and fear of the threat. This means that the same attack method and similar level of threat can cause significant health differences in affected populations depending on communication aspects, strategy formulation, organizational issues and individual leaders' abilities.

Tab. 1. Distinctions Between Terrorism and Bioterrorism [43].

Name	Terrorism	Bioterrorism
Speed at which attack results in effect	Immediate	Delayed or Prolonged
Site of attack	Specific	Unknown
Knowledge of attack boundaries/scope	Well understood	Unknown
First responders	Police, fire, EMS	Physicians, nurses, public, health officials
Distribution of affected patients	Concentrated area	Geographically dispersed
Decontamination od victims and environment	Confined environment	Geographically dispersed
Isolation/Quarantine	Not usually necessary	Required for transmissible diseases
Medical interventions	Trauma, first aid	Antibiotics, vaccines

The case study of bioterrorism and human psychosocial reaction

The act of bioterrorism prepared against the US postal system took place on Tuesday, 18 September 2001. It consisted on sending five letters that contained the anthrax spores (Bacillus anthracis). The attacks were named by the Federal Bureau of Investigation as Amerithrax [4] and occurred just a week after the September 11 attacks. Letters containing anthrax were sent to media offices and to two Democratic US Senators. As a result of this attack, the activities of the US Congress and the Supreme Court were suspended, as were postal operations covering the whole country. Eighteen out of twenty-three infected men survived, unfortunately, despite the treatment, five died. Over 33,000 have been subjected to prophylactic treatment. The total cost of expenses related to the neutralization of the impact of this attack is estimated at over USD 6 billion USD [40]. So the consequences were absolutely disproportionate to the costs incurred by terrorists. After this attack, the US Congress decided on a new legal regulation. This was set by the executive order of the White House Home Security Bureau on October 8, 2001. It defines the role of a new office in response to bioterrorism involving the coordination of:

1. Development of monitoring protocols and equipment for a use in detecting releases of biological, chemical and radiological threats.
2. Efforts to ensure public health readiness for a terrorist attack, including reviewing the vaccination policy and reviewing the adequacy and, if necessary, increasing the supply of vaccines and pharmaceuticals and hospital potential.
3. Increase efforts to prevent unauthorized access to development and unlawful import of chemical, biological, radiological, nuclear, explosive or other similar materials that could potentially be used in terrorist attacks in the United States.
4. Retention and disposal of biological, chemical, radiological, explosive or other hazardous materials in the event of a terrorist attack or attack involving such threats and coordination of efforts to mitigate the effects of such an attack [16].

U. S. Postal Service has become a place of chaos and confusion, which had wide social, behavioral, psychological and organizational consequences. They affected both local communities and the whole nation. Although the purpose of bioterrorism was focused on specific people, it was at this

time that receiving letters or parcels became dangerous or at least very unpleasant. The US government and public health organizations were not prepared to counteract both biological effects and mental health problems. Today, however, it is known that awareness, understanding, planning, preparation and perhaps the most important practical exercises are crucial for the proper response of society to terrorism and have far-reaching consequences for effective coping with bioterrorist action. Bioterrorism raises special safety rules and restrictions such as manage and secure vaccination programs, ensure limited access to the prophylactic medications, possible evacuation of affected people and place assignment for isolation. From psychological point of view establishing and training professional management could reduce the size of the attack [19]. This requires not only preparation, but must also influence media activities, ensuring adequate communication of risks, public education programs and leadership, to maintain public confidence and ensure that people follow the guidelines indicated by these measures in the event of the spread of such disease.

Bioterrorist acts can be targeted at any number of goals such as achieving a political goal, making revenge, punishing unbelievers or shaping an apocalyptic vision. Victims who have been killed, wounded or even directly affected are rarely the main target. It is, however, fear and fear installed in the on society for as long as possible, the loss of a sense of personal and community security and disruption of critical social infrastructure that can shake down maim the economy and leadership of the nation. Immediately after the terrorist attack on the US postal system, people reacted unsuccessfully because they did not receive any reliable information from leaders or made decisions based on fear causing unhelpful behavior and even panic. Biological weapons are expected to bring not only death and negative consequences to the biologically healthy infected people, but also a psychological and psychosomatic symptoms such as prolonged anxiety attacks, including nausea, fever and headaches, long-term malaise. In addition, psychosocial distrust is to spread not only towards the government and medical staff, but also in relation to people from the neighborhood [33]. In above all the aim of a bioterrorism is breaking the public trust in administrations and public institutions. It is also to prove that deliberate damage is easy and possible at any time, and the government, politicians and local leaders are not able to prevent fatal consequences. Bioterrorism is a special type of man-made disaster that causes a much larger percentage of psychological victims than natural accidents or technological accidents [20]. There will be traumatic disorders such as unexplained somatic symptoms, depression, emotional outbursts, anxiety disorders, increased alcohol consumption and addictive substances [10]. The act of a bioterrorism requires not only the segregation of medical victims, but above all an effective risk assessment related to the possibility of panic behavior [38]. Issues related to panic include a psychological mechanism that narrows down human thinking to a selfish form of action. There is a belief that there are no other ways to escape this situation. Although there are not many examples of panic reactions after a catastrophe, it is still possible to take into the account among the risk factors of panic. Norris, Friedman, Watson [31] conducted a review of epidemiological literature investigating 160 samples of disaster victims published since 1981 on the psychological effects of a natural and man-made disasters on more than 60,000 people. As with other types of disasters, an attacker-terrorist will lead to mental disorders and psychiatric diseases. One of the specific threats is the possibility of being a witness to the death of a family member or close relatives, which may cause symptoms of PTSD, depression, who were susceptible to an attack before the event or are already suffering from the disease. Example of in clinical trials of victims of the attack in Oklahoma City stated by. North, Pfefferbaum, Kawasaki, Lee, Spitznagel [32] for example found that 34% victims had PTSD and 22% a severe depression.

Aviation bioterrorism

Every year, around 4 billion passengers travel by air [21]. This huge mass of people can also pose as a very serious threat to the risk of transmitting infectious diseases. This can happen accidentally by a single contact with an infected passenger or even worse, deliberately. The intention of conscious contagion of passengers, carried out in a closed cabin of aircraft, as well as other people after leaving the aircraft by the patient, is a pure act of the bioterror. Due to the fact that various infections can be easily transferred from person to person, but in a well-ventilated room, can limit the risk of disease transmission is limited to two rows of seats adjacent to the infected person. Unfortunately it is difficult to assess the effectiveness of such action. Medical data indicate that such cases are rare and have never led to an outbreak [28]. However, due to the long-term effects of transmission of infectious diseases from one continent to another, this risk can not be exclud-

ed [47]. Currently, there is no effective method of eliminating this type of suicide passengers to prevent them from entering a public space, such as an airplane and an airport, because, inter alia, the period of incubation of an infectious disease may be asymptomatic, so no one will notice it. There are two important elements that can be used in terrorist tactics: an airplane treated as a weapon and a human being as a carrier of biological agents. In this way, it is possible to write scenarios describing the possible course of such an event. An example of a virus that can be taken into account in such a scenario is, for example, smallpox, because the incubation period is about 2 weeks and is easily transmitted between people. Another may be a virus that causes symptoms of acute respiratory failure (SARS). Terrorist operations using these types of pathogens can have very uncertain consequences, among others because the extent of infection is unknown due to the high unpredictability of the spread of the disease. These properties are therefore ideal for terrorists, because they cause anxiety and a sense of overwhelming danger that can not be controlled and thus controlled and ultimately lead to organizational information chaos [30]. In such conditions, opposite concepts of solving the problem are created. Bioterrorist attacks are often followed by the pattern of transferring "bad things" by "bad people". Paradoxically, pilots and passengers are thoroughly checked at airports, but transport of goods, especially on domestic lines, is subject to much less restrictions. It can be a way to carry pathogens. Another risk is the possibility of spraying biological agents from the plane's deck. It can also be sprayed over large urban agglomerations and drinking water reservoirs. Due to the relatively small amount of aerosol and the potentially large number of infected people, this method seems relatively easy to use. Aerosols for infection are odorless and tasteless, invisible and very cheap compared to other types of weapons of mass destruction. The carrier of such an aerosol can be an airplane, a helicopter, and perhaps primarily an unmanned aircraft or a small drone, because in this case there is no risk of catching terrorists involved in such an operation. The use of the aircraft for a large-scale biological attack is a completely real scenario, which unfortunately can be fulfilled. There is also a separate type of terrorism called agroterrorism but one can also distinguish its subgroup of aviation agroterrorism, consisting in the use of an airplane to try to spread germs in agricultural areas. The purpose of this action is to poison large areas, farm animals and pathogenic pathogens against livestock and agricultural crops so as to cause food poisoning in order to change people's social and eating habits for humans and forcing change in eating and social habits [14]. This will trigger numerous social tensions. The big problem is the lack of protection of agricultural areas against such an attack. The transport of biological pathogens can be linked to an advanced drug transfer methods. For example, there were many cases of drug trafficking using a drone. An attack of microdrons may also be considered, which can be completely undetectable or detectable to a minimum, although the amount of transmitted infectious agent would also be small in this case. In this context, it should be noted that air is the most suitable environment for transporting biological agents. It seems in this situation that the basic difficulty of bioterrorists is not the transfer of a biological factors, but their production [23].

SUMMARY AND CONCLUSION

The characteristic use of a biological agents often means deferring the reaction of the human body for an indefinite time depending on the factor used and its real impact. Lederberg [25] thinks that the vulnerability of the US to bioterrorist attacks is high, and the threat "is probably the most onerous and the most serious security challenge we face." In bioterrorist activities, the threat is not anthrax, but an overwhelming fear of possible, all-encompassing consequences. To an American outpost, five people have been infected with anthrax, thousands have been tested, and millions have feared for their lives. Uncertainty about future acts of a bioterrorism is extremely painful, involves an unpredictable range of activities that nobody has experienced before, so there is anxiety that Butterworth calls "anticipation of fear" [6]. In the psychology of terrorism, it is important to inform the public that this method of destabilizing social life is more related to subjective perception (also of a collective nature) than to reality. To win this war, people cannot succumb to the propaganda of terrorists strengthened by free media, give faith to rumors or, unexpected information and analysis of the so-called "specialists". However, it should be noted that in order to meet these challenges, a high level of social trust is needed not only for the government, but also for political opponents and scientific authorities who should represent a unified, rational and balanced message. Society should also be informed about facts, because concealing the truth leads to conspiracy theories, dissemination of untested impressions. The main dis-

tinguishing feature of a biological weapons is that even a small amount of pathogen can be enough to contribute to the death or serious illness of many people. The period of full development of the destructive force is not immediate; therefore it is extremely difficult to prepare activities in terms of readiness, protection and response. There is still a gap in knowledge and scientific analyzes regarding the psychological effects of bioterrorism and ways to protect people from the devastating consequences of such a catastrophe. Examples of other events, such as natural epidemics and accidents, are a kind of background.

The history of previous experiences includes tips on the preparation and plans of bioterrorism involving public organizations. These experiences emphasize the individual psychological weight of a risk perception and decisions regarding the preparation of medical assessment in the event of a biological attack [35]. The medical healthcare system must be prepared for the management of a bioterrorist event. These experiences emphasize the possibility that medical facilities may be overwhelmed by the needs of people who have been severely or potentially affected. Wessely, Hyams, Bartholomew [48] described psychosocial diseases in connection with 9/11 September, 2001 at a school in Washington, where bioterrorist rumors developed an anxiety reaction of 16 students and one teacher, hospitalization was necessary for psychological reasons, although from a medical point of view they were not in danger [41]. What is needed to develop an effective program to counteract the possibility of a bioterrorist attack is primarily a modern system for detecting the threat of biological contamination, as well as methods for detecting drones, including minidrons [7]. Both tasks seem difficult to implement, but are necessary in the context of building effective firewalls. Secondly, it is necessary to create scenarios for a possible coping with epidemics, but also for psychosocial reactions in response to these threats [36]. Hyams et al. [20] argue that as a result of the experience gained from the World Trade Center attack on September 11, 2001 and the subsequent mailing of anthrax in October 2001, four long-term health consequences should be seriously considered: (1) chronic injuries and pathogen-induced diseases; (2) issues related to possible infertility of infected people (3) psychological effects; and (4) an increased level of unexplained psychosomatic symptoms. So two of the four symptoms concern psychological problems, these issues still seem underestimated both by government agencies and the society itself.

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PLANNING ACTIONS IN THE EVENT OF AN EPIDEMIC OF INFECTIOUS DISEASES

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Introduction: Ease of travel, especially by air, increases the risk of spreading dangerous infectious diseases not only within countries but also between continents. The authors analyze the actions taken during the EBOLA epidemic in 2014-2015 against the background of the procedures implemented during the influenza pandemic and SARS epidemic.

Problems: The main problem before and during an epidemic or pandemic of infectious diseases is the preparation of appropriate tools to be used from the first moments of the threat. Close cooperation between and coordination of all services involved in the decommissioning of epidemic outbreaks is becoming essential.

Conclusion: It is necessary to develop appropriate plans concerning unified risk management procedures. They should take into account not only the activities of medical services, but also representatives of other areas (including airline workers, critical infrastructure systems, the media, as well as representatives of the political level).

Keywords: epidemic, infectious diseases, EBOLA, SARS, influenza pandemic, air transport

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INTRODUCTION

The epidemic of the EBOLA viral disease, which occurred in 2014-2015, showed that infectious diseases cannot be treated solely in the context of a historical or exotic phenomena. Both previously known infectious diseases and the so-called emerging diseases are the cause not only of human illness and death, but also of huge economic and political losses.

The constant accompanying development of civilization is simultaneously a source of new tools useful for responding, as well as an element conducive to a faster spread of infectious diseases even from the most distant regions of the world. Experts stress that the time needed to bridge the gap between the two most remote places on earth is shorter than the incubation period for infectious diseases that have so far been identified in humans. As a result, we may be exposed to new threats every day, the effects of which are difficult to predict [2].

The current political situation poses another threat as well. The increased threat of terrorist attacks worldwide, including in Europe, makes bioterrorism a current phenomenon [2].

Therefore, with progress and political changes as well as increasing public health threats, our approach to action planning in the event of an epidemic of infectious diseases must be modified and the treatment of infectious diseases as an exotic problem that does not concern us must stop. These changes were partly introduced already during the preparations for the influenza pandemic, carried out before 2009, however, when analyzing the later actions, e.g. during the EBOLA epidemic, it is clear that unfortunately they have not become a standard in responding to other infectious diseases [16].

Preparations for most crisis situations are carried out on a multidirectional basis, at all level of responses, but very rarely as systemic, long-term strategies [16,17]. According to the authors, the priorities in the area of preparation are most often imposed by the existing or upcoming crisis situation and are not aimed at improving the entire response system in their nature, but only at resolving an existing or upcoming threat. Preparations are usually conducted on a "crisis to crisis" basis, and a multitude of teams, plans, procedures and tools are not always conducive to an optimal exchange of information or a more comprehensive approach to the issue, and often even lead to chaos and decisions that are not very rational. Very often, the need for the universal nature of adopted solutions that could be included in more practical, universal strategies is not taken into account. Lack of such solutions results in the fact that the effectiveness and efficiency of actions taken at the moment of occurrence of a specific threat is often inadequate to the needs and generates both financial and time losses, which, in the opinion of the authors, is of great importance in the case of continuous shortages of both time and money in the entire crisis response system.

Of course, key aspects in biological emergency preparations are those arising from the nature of the biological agents, the characteristics of the exposed population, but also from the risk management measures available. Unfortunately, at the present we must also accept the fact that the political and economic situation has a huge impact on the action planning possibilities. The negative influence of these factors needs to be analyzed very carefully in order to improve the efficiency of the preparations. As previous epidemics have shown, political decisions are often the cause of difficulties in the implementation of plans and procedures, resulting in a loss of public trust in the actions taken by medical experts.

In any crisis situation, including an epidemic of an infectious disease, the media play an important role. As experience from e.g. the epidemic of the viral disease Ebola shows, the role of both traditional media (radio, television, press) and e.g. digital media and information tools available in cyberspace is huge. Their inclusion in preparation and response plans is a necessity which requires long-term action. According to the authors, it is necessary to standardize procedures and to cooperate closely with the WHO in this respect.

Taking the above into account, the aim of the study was to:

1. Demonstrate the state of preparations for threats related to the spread of dangerous infectious diseases.
2. Discussion of the problems identified by international expert groups, in the context of local and national preparations.
3. Identification of proposed systemic solutions necessary to continue preparations.

THE EBOLA VIRAL DISEASE EPIDEMIC

The Ebola viral disease virus was first identified in the 1970s Since then, until 2013/2014, all outbreaks of this disease had a similar course [13]. The disease was mainly found in Central Africa, with several to several hundred deaths usually occurring in the identified outbreaks. At the same time, they were limited in time, place and population.

Between the identification of Ebola hemorrhagic fever and 2014, a total of approximately 1,500-1,600 deaths (fewer than 40 deaths per year since the virus was discovered) were reported. Despite the use of the Ebola model in many exercise, plan and procedure scenarios [21,22], in America, Asia and Europe it still was an example of an exotic or bioterroristic disease.

The situation changed at the turn of 2013 and 2014, when the cases were confirmed for the first time in West Africa [3,4,13]. The scale of the epidemic, the place case of illness and death occurrence, surprised everyone. Between 2014 and 2015 alone, the disease caused 27,000 cases, including 11,000 deaths. It was the longest lasting epidemic of this disease [7,20]. Although the first cases occurred in South Guinea in December 2013, the epidemic remained unrecognized until March 2014, allowing the virus to spread to Sierra Leone and Liberia (via land borders) and by air to Nigeria, the most populated country in Africa. Despite alarming appeals from non-governmental organizations present in the region, including Doctors Without Borders, about the growing scale of the threat and the need to take urgent action, it was not until August 2014 when the World Health Organization (WHO) has recognized this epidemic as a Public Health Emergency of International Concern (PHEIC) in accordance with the International Health Regulations 2005 (IHR 2005).

During the course of the epidemic, the virus spread to other African countries (Senegal and Mali). In addition, Ebola infections have occurred in the UK, Italy, Spain and the US, countries providing help to infected people. In order to receive appropriate treatment, those affected were transported to their countries of origin. Naturally, imported cases of the disease occurred in the USA, Italy, Great Britain, and virus transmission occurred in Spain and the USA [20].

Because the course of epidemic was so rapid and differed from any previous one, many experts asked themselves what caused such large differences in its course, in comparison to previous epidemics of this disease [3,4,7].

Initially, it seemed that the virus that had appeared in the region quickly mutated and gained the possibility to spread more easily and greater virulence. The possibility of changes in the genome caused by late diagnosis of the disease and long-term circulation of the virus among the population was also considered [3,15,20].

Later genetic analyses did not confirm these hypotheses. The virus circulating in West Africa was very similar to the one found in Central Africa. The differences in the genome were so small that they should not cause differences in the spread of the disease. Also, the pathogenesis of the disease did not indicate that the severity of the outbreak and the characteristics of the epidemic were caused by changes in the virus characteristics [16].

In view of the above, a number of questions arose:

1. What was the cause of such a large scale epidemic?
2. What factors prevented us from being able to control it quickly?
3. Why did the tools developed for responding in case of an infectious disease not work, or proven to be insufficient?
4. Did the 2005 IHR, as the legal basis for preparation and response, trained during the influenza A(H1N1)pdm09 pandemic among others, prove ineffective in the case of other infectious diseases? [11.12]

To answer these questions, many international expert teams have taken action to carefully analyze the situation and the actions taken in order to identify both the strengths and weaknesses of the system and to implement corrective actions [16].

Also from Poland's perspective, it became necessary to carefully analyze the actions taken during the Ebola epidemic at each level of response, taking into account the specificity of countries particularly affected, referring them to the actions taken during previous epidemics of infectious diseases and developing on this basis appropriate preparation plans for our country.

The analysis cannot, of course, ignore the geopolitical situation of West African countries, since one of the main and quite obvious reasons for the failure of the response at national level in the region was the result of a long lasting civil war as well as the political and economic weakness of both Liberia and Sierra Leone. During the war, existing infrastructure, including medical infrastructure, was significantly destroyed. The lack of a coherent system of surveillance over infectious diseases caused delays in reporting in practice and thus prevented efficient implementation of early actions adequate to the scale of the threat. Ubiquitous corruption and a total lack of public trust in the governments of these countries proved to be an important factor. The authorities did not know how to react, primarily placing economic reasons above efficient and effective, and most importantly - quick response. Also, the great effects of delayed response to the threat were not foreseen [16]. It needs to be noted that a similar situation occurred during the SARS epidemic

when a suspicion that China tried to "cover" the epidemic and did not report the cases to the WHO arose. This delayed the containment of the virus at the international level and caused considerable economic losses [11,12].

It is on the basis of this experience that the 2005 IHR imposed an duty to report information on risks on WHO Member States. According to the adopted assumptions, each country has 24 hours to report [11,12]. However, as the Ebola epidemic has shown, the possibilities for enforcing this duty remain very limited.

The social and economic situation of the countries affected by the Ebola virus has also had a huge impact on the shortage of medical staff. In Liberia alone, according to 2010 data, there were 51 doctors per 4 million people. At the same time, doctors or nurses from other countries often faced mistrust in many places they worked, especially when they appeared in strange and dangerously looking protective clothing. Often, medical staff dressed in such a way was a source of anxiety and sometimes even fear, which made it difficult for them to work with the local community.

Lack of previous experience, concerning the reaction during the viral disease Ebola was also not without significance. It was not present in the region before and, due to its non-specific symptoms, it took about three months to identify the real causes of the disease and death. In many places (according to local authorities of e.g. Liberia), Ebola has not been taken into account as a cause of illness for a long time and has not been registered in surveillance systems. The causes associated with the non-specific symptoms were often seen in other diseases, including malaria in these areas in particular.

The nonspecific course of the disease and the lack of appropriate infrastructure and equipment have also made it difficult to organize special isolation facilities for people infected with the Ebola virus, the so called Ebola Treatment Units – ETU. When the onset of symptoms of the disease occurred, the persons were directed to specially prepared rooms. Unfortunately, while waiting for laboratory tests, which lasted up to 2-3 days, the infected people stayed in one place with those that showed symptoms caused by other diseases. This posed a risk of further spread of the disease to people suffering from other conditions. There is no data available on the number of hospital-acquired infections that have occurred in connection with such management, but it can be assumed that such organization has not been conducive to building confidence in medical procedures and proceedings. Those sent to ETU often thought that they were being sentenced to death in isolation in these places. There were cases of people diagnosed with Ebola, who, not wanting to undergo treatment in an ETU, traveled many hours to other distant places to meet the family. This, of course, caused the spread of the disease and new outbreaks.

Insufficient security of medical staff during the course of the epidemic was a serious problem. The lack of appropriate protective suits, incompetent use of personal protective equipment caused the disease in the initial period of the epidemic to affect, to a large extent, the people who took care of the sick. This is why some doctors or nurses, fearing for the health of their own and that of their families, have considered refusing to help. Similar situations occurred during the yellow fever epidemic in the USA, SARS or the influenza pandemic [11]. The experience of doctors working in countries affected by dangerous infectious diseases has often shown how difficult were the choices they were forced to make.

It should be emphasized that working in protective suits, which provide the comfort of safety for medical personnel, requires appropriate training. In addition, this work is very physically demanding and therefore time-consuming. The number of people seeking help was enormous, which created discomfort for medical workers, including mental discomfort. The situation was improved by regular training sessions addressed to the staff going to the areas of disease occurrence which were conducted by CDC, WHO or the Doctors Without Borders organization, among others [10].

The traditions and beliefs of the local population concerning e.g. care for the sick persons and methods of burial, during which direct contact with corpses often took place also proved to be a big problem [1]. Therefore, as it was the case during previous Ebola epidemics, the virus spread most intensively among those who took care of the sick or took part in funeral ceremonies [1,8,14].

The lack of an effective surveillance system, difficulties in reaching all the regions of the country where the disease occurred are other key problems which, unfortunately, have also had a huge negative impact on the epidemiological situation and the ability to react in other regions of the continent and even the world. It has been repeatedly emphasized that the existing possibilities for movement of people between villages and towns have led to the rapid spread of the virus from east

to west and only being stopped when it reached the ocean, a natural barrier.

The problems described above resulted, inter alia, from the lack of precise action plans, also at national level, in particular with regard to the proper functioning of the crisis management system. The procedures adopted were so lacking that they could not cope with the rapidly deteriorating epidemiological situation. This caused great difficulties in utilizing the international aid that arrived to countries affected by the pandemic. The lack of an appropriate system and system management has shown that it is not enough to have the resources alone, when, for various reasons, it is not possible to provide them to those in need or to the medical staff involved in the decommissioning of the outbreaks. Even large financial outlays do not bring the expected results without the support of the entire system.

The actions taken during the course of the Ebola epidemic, as well as the influenza pandemic, have also shown how important it is to strike the right balance between limiting the spread of the disease and minimizing its negative effects. According to several experts [16,17], many places neglected to act in the focal points, focusing entirely on the isolation of patients, and not on providing them with adequate medical assistance during the Ebola epidemic. Isolated people, who virtually were not granted proper medical care, did not want to submit themselves to restrictions and avoided services involved in extinguishing outbreaks of disease. Only when the population noticed that cured people were returning from the places of care of the sick it was seen as a positive turning point of the epidemic. This helped to improve cooperation between the local community and medical staff.

ACTIONS OF THE AVIATION SECTOR DURING THE EBOLA VIRUS EPIDEMIC

In addition to the problems in the functioning of the medical sector, the performance of other key elements of national response systems has also been the subject of a lot of controversy.

The functioning of airport services and airline representatives in the affected countries raised many doubts [5,18]. For example, out of 7 airlines using the Monrovia airport (Liberia), 5 have withdrawn and only 2 have remained. This significantly reduced the ability to deliver food, disinfectants and specialist equipment by air, and made it difficult to evacuate and turnover personnel.

Measures to reduce air communication have been taken despite clear WHO guidance on the lack of the need for travel restrictions. These decisions proved to be another negative factor influencing the correct response to the threat. For the citizens of the affected countries, this created a feeling of fear and complete isolation from the rest of the world. Air traffic restrictions have been imposed on Liberia, Sierra Leone and Guinea, yet no restrictions have been imposed on Nigeria, where, after all, cases have also been confirmed. This indicates that the WHO's recommendations are open to interpretation, which should not be the case in such an events.

Some countries, without consulting neighboring countries, decided to close their borders with the affected countries (e.g. Senegal closed its border with Guinea). These actions were not justified in any way and were undertaken contrary to the clear recommendations of the WHO.

A similar problem arose with the introduction of screening upon entering and leaving airports, seaports and at land crossings [18]. The WHO has developed clear guidelines in this respect, which state that it is appropriate to introduce 'exit-only' screening from countries with persistent virus transmission [5,6,19]. This was to prevent people showing symptoms of Ebola infection from being allowed to travel. In the document entitled "WHO Interim Guidance for Ebola Virus Disease: Exit Screening at Airports, Ports and Land Crossings (6 November 2014)", the WHO recommended the countries with reported Ebola virus transmission to carry out a screening on departure that included at least:

- filling in a relevant questionnaire,
- temperature measurement,
- in case a fever was indicated, an assessment of the health status and the degree of risk of the fever being caused by the infection with the Ebola virus.

In accordance with the recommendations, any person with symptoms corresponding to the Ebola viral disease and those having had contact with them should not travel [5,19]. The only exception in this case was transport connected with medical evacuation. The screening on departure was introduced by all affected countries where virus transmission was detected. In most cases, these activities were carried out with the support of the CDC. However, experience gained after only two months of applying that measure has shown that the real possibilities for detecting cases by that means are very limited. Among 36,000 people subjected to screening, only 77 were considered

likely to be infected. After specialist examinations, none of the persons confirmed the preliminary diagnosis.

However, the WHO did not recommend the use of screening on entry into countries with persistent virus transmission. The ECDC also stressed in its recommendations that the introduction of entry screening can only be considered if there are doubts about the effectiveness of exit screening. At the same time, it was stressed that if countries decide to introduce such a measure, they should develop precise plans and procedures so that these actions would not lead to disruptions and delays in international traffic and transport. The WHO also recommended that not only the policy aspects should be taken into account in the decision-making process, but also the results of a thorough analysis of the benefits and losses of the decisions made. At the same time, it was recommended to consider the following:

- taking into account the lack of evidence that screening is effective in preventing or delaying the spread of infectious diseases,
- in the case of temperature measurement, using appropriate equipment and ensuring that it is used by trained personnel,
- taking into account the fact that the use of temperature measurement as one of the screening methods requires the development of methods for further treatment of patients with elevated temperature [19].

These recommendations were based on experience from previous epidemics (including SARS or pandemic influenza), which have shown that even among infected people, the possibility of detecting cases by means of this method is very low and the cost of introducing these measures is very high. At the same time, they require the use of appropriate equipment and properly trained staff. They can also have a very negative impact on the smooth flow of passenger transport and the functioning of airports. Despite these recommendations and the lessons learnt from previous epidemics, particularly SARS, some countries have decided to introduce this measure as well.

Transportation of samples of biological material for laboratory tests also turned out to be largely problematic. Despite quite clear guidelines on safe transport, many air carriers and delivery companies did not want to provide these services, justifying it with concern for the health and safety of staff.

The introduction of quarantine in both West African countries and the US has been similarly controversial. In the United States, the CDC decided that quarantine should be compulsory for all health professionals who have been caring of patients in affected countries. This was met with great opposition from many circles, including non-governmental organizations [16]. It was stressed that there was no scientific evidence of the spread of the virus from persons who did not show symptoms of the disease and that quarantine of returnees from affected areas, but not from symptomatic areas was therefore a superfluous measure, according to many experts.

Many problems with introducing quarantine have also been identified in West African countries. Food and basic disinfectants were often lacking in quarantine facilities. As mentioned above, this was due to the reduction of air transport, among others. Additionally, the fact that these places were protected by the army had a negative impact on the mental state of the people undergoing quarantine, which contributed to the rising of an atmosphere of fear and danger.

As in the case of the aforementioned examples, it is clear that the lessons learned from previous epidemics are not being used at all in the case of quarantine. Even a fairly thorough analysis of the costs and consequences of this measure did not provide a sufficient argument for decision-makers.

All the above problems identified in the countries affected by the epidemic, both at the local and national level, were compounded by the fact that WHO did not respond quickly enough despite the threat signals from non-governmental organizations (including Doctors Without Borders) and, according to experts the organization's response was too late [16]. The response only came when the number of illnesses and deaths was enormous and when it was very difficult for the international community to respond. It is, of course, difficult to assess accurately how much earlier and more decisive action by the WHO would have helped to improve the situation, however it is very interesting to compare the situation again with the influenza A(H1N1)pdm09 pandemic, where the WHO response was considered too early. It has been repeatedly stated that due to the mild course of the disease, the WHO response and recommendations should be milder. It is also difficult to assess whether this criticism has had any impact in delaying the decisions taken during the Ebola epidemic.

Particularly intense criticism concerning international action was voiced due to inadequate implementation and enforcement of the IHR 2005 [11,12,16]. This document, based on the SARS conclusions, among other things, sets out not only

the rights and obligations of the various institutions involved in the response, but also, and this is important in terms of coordination, the range of key options that Member States should have at their disposal. They cover many aspects of preparation, from the preparation of staff and medical infrastructure through communication, surveillance of infectious diseases, involvement and preparation of all services involved in the elimination of the threat.

In order to improve preparedness and response capacity, the WHO has developed specific tools for capacity assessment. They allow to identify the strengths and weaknesses in the overall response system. Available data [11,12] show that currently only 20% of WHO Member States have reported preparedness in the context of having key response capabilities. However, it should be stressed that this result may be overestimated due to the fact that this preparedness is reported on the basis of self-assessment and may be influenced by a multitude of factors, including e.g. political factors. The Ebola epidemic has shown that the WHO does not have the capacity to enforce the existing requirements. Despite Member States accepted the 2005 IHR and the deadlines for improving their systems, they are not taking sufficient action [15].

The 2005 IHR also defines the WHO Director-General's duty to declare a Public Health Emergency of International Concern (PHEIC). However, as the influenza pandemic has shown, the announcement of such a state has many consequences not only in relation to the actions taken by the medical sector, but also in relation to the possibility / necessity of implementing measures that may have a huge impact, for instance, on the political and economic aspects of a given region [15,17]. During the course Ebola epidemic, the WHO announced the PHEIC only in August 2014. According to the experts, this decision was taken too late, and as it was the solely responsibility of the WHO Director-General, it was not possible to consult more widely on it.

DISCUSSION AND CONCLUSION

The above analysis only includes selected examples of preventive measures that can be taken during an outbreak of infectious diseases. Analyzing the conclusions drawn from the preparation and response to the influenza pandemic and comparing them with the actions taken during the Ebola epidemic, we can certainly conclude that it was not fully drawn from the lessons that influenza, SARS or MERS gave us [9,16]. Many countermeasures were taken hastily, sometimes at a higher loss than in the absence of action in a given area. The absolute lack of long-term measures and clear procedures to prepare health personnel for an epidemic, or the lack of adequate medical infrastructure and personal protective equipment, was very evident. It should be stressed that all these elements of preparation were described in the 2005 IHR as basic requirements for WHO member countries. Unfortunately, as shown by the epidemic, there have been insufficient mechanisms to be used for assessment and verification of the state of preparation of countries for this threat. These problems concerned not only West African countries, but also developed countries in Europe and America. Many of the problems described in the context of the actions presented on the example of African countries are unfortunately descriptions of the weaknesses of many other national systems as well [17].

It is worth noting that during both the influenza pandemic and the Ebola viral disease epidemic, a very similar range of action was taken into account. These included a broad response from the medical sector, including the preparation of hospitals and other care facilities, the health protection of health care personnel, the surveillance of infectious diseases, and the use of medicines and vaccines, among others. A wide group also consisted of so-called non-pharmaceutical measures including, for example, the possibility of isolation and quarantine, school closures, travel restrictions or the use of personal protective equipment in the entire population. Communication, both between response services and with the public, was an important part of the preparations in each case.

All these measures have already been used in the past and conclusions as to their effectiveness or lack thereof were based on the course of previous epidemics. In-depth analyses in this respect have been carried out in connection with pandemic influenza preparations, during which the validity of the implementation of specific strategies has been discussed over the years. Of course, in addition to the epidemiological situation, the analyses also took into account climatic, geopolitical and cultural differences.

Unfortunately, as the Ebola epidemic has shown, the solutions developed in many cases have not been reflected in the response to the threat [16,17]. The reasons for this state of affairs can be seen, among others in limited communication between experts dealing with various infectious diseases, as well as the multiplicity of existing plans, procedures, strategies and lack of coordination of activities. Sometimes, as in the case of previous outbreaks, panic and political correctness have proved to be more important advisors than scientific reports and previous experiences.

Errors were also due to the lack of a single coherent strategy which would set out the main objectives

for action during infectious disease outbreaks. It is extremely important to draw up such a document beforehand, and not during an epidemic. This will make it possible to make appropriate arrangements between the various services in advance, to practice the assumptions made and to avoid pressure from politicians, the media and pseudo-experts alike. Such a strategy, which applies to Poland as well, should contain the key directions of the country's response and long-term planning activities in various areas, including, above all, precise assumptions concerning the training of personnel in the field of personal protection and response during an epidemic of infectious diseases. It should also specify to what extent training should be provided to all staff of the medical sector, and to what extent only to those selected, designated to respond in situations of similar threats, e.g. adhesion to Poland of a dangerous infectious disease [10]. The strategy should provide for a long-term program of such training, as a continuous process, combined with exercises and aptitude tests. The Ebola virus epidemic has shown how important it is to properly train and secure staff - this should be the basis of any national preparation strategy.

It is necessary to agree precisely upon the assumptions concerning the response during an epidemic of infectious diseases, e.g. in the scope of activities of the civil aviation sector, the rules of school closures, or the introduction of isolation and quarantine. All of this goes well beyond the remit of institutions responsible for public health . That is why it is so important to make others aware of their role, as well as their responsibility in this type of crisis.

Establishing general rules of response, together with a clear justification, should be the basis for the preparation and response of each country. As was the case during the course of preparation of the pandemic influenza plans, these strategies should be discussed at international level, at the very least by neighboring countries. Preparations for the influenza pandemic have shown that such consultations are possible and that, even if national assumptions differ, common solutions and a possible compromise on discrepancies is achievable.

In order for international action to be carried out properly, it is necessary to strengthen the role of the WHO, the weaknesses of which were evident during both the influenza pandemic and the Ebola viral disease epidemic [16]. The role of this organization is enormous, but it should be able to enforce the accurate, previously accepted assumption of the IHR 2005 better. The current level of implementation of this document is far from sufficient.

At the European Union level, we should return to the assumptions of "Generic preparedness" described, among others, in the Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions on strengthening coordination on generic preparedness planning for public health emergencies at EU level (November 2005), which were discussed earlier, however, due to the influenza pandemic, they have been pushed aside, or those described later in "Strategy for Generic Preparedness Planning Technical guidance on generic preparedness planning for public health emergencies" (April 2011) and Decision No 1082/2013/EU of the European Parliament and of the Council of 22 October 2013 on serious cross-border threats to health. These documents, updated in accordance with new experience, could form the basis for further work.

Properly defined cooperation with the media and education of the public should also be an important element of the strategy. As shown in previous analyses, these two elements have a great impact on the correct response during crises and are now a key element of the crisis management system in the event of an epidemic of infectious diseases. It should be stressed that only long-term educational and awareness-raising action can bring results in this area.

It would seem that the above mentioned conclusions are a rather long list of difficult to implement requirements, as well as too idealistic an approach to planning. However, in the authors' opinion, this is one of the ways to improve the response, simultaneously taking into account such important elements as the safety of medical personnel or the involvement of the public in the cooperation. This list does not cover all areas of preparation. It should be developed in the light of the level of preparation achieved.

According to the authors, the system cannot be built or even improved during or just before the epidemic. Such actions need be done well before the crisis, so that changes and modifications, sometimes very controversial, can be made without pressure and can be tested. Raising public awareness of the risks, opportunities to contribute to the preparation and, at the same time, the costs of not participating in the preparation process is crucial as well. All of this requires a long-term educational effort, not ad hoc action.

The epidemic of viral disease Ebola was not a surprise. It was a crisis that we should have expected. The approach that 'it is not our crisis, it is not our threat' failed. Changing this mindset in regard to both naturally occurring epidemics and the possibility of a bioterrorist attack should be a first step in further preparation.

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31. The International Scientific Conference organized by the European Health Psychology Society (EHPS) took place from August 29th to September 2nd in Padua, Italy.

The aim of the annual EHPS Conference is to present and discuss the latest theoretical and practical achievements in the field of health psychology in an international group of representatives of the world of science, among whom are primarily psychologists. Particular emphasis is placed on the presentation of the latest ideas and the evaluation of the effectiveness of different methods of intervention . This year's EHPS Conference on "Innovative Ideas in Health Psychology" was inaugurated by Prof. Sabina Cipolleta. During her speech she presented, among others, special guests: Prof. Fabio Lucidi, Prof. Sherry Pagoto, Prof. Rory O'Connor i Prof. Anmarie Cano. It is worth noting that during this year's EHPS Conference almost 700 scientists from 47 countries presented the results of their research. 22 symposia, 43 thematic sessions and 3 poster sessions took place. Polish scientists, comprised of 20 active participants of the conference, presented mainly posters. In addition, they delivered 10 reports in thematic sessions: A. Banik, K. Czekierda, A. Łuszczyńska (Psychology Department, SWPS-University of Social Sciences and Humanities in Wrocław) - „Health-related quality of life and self-efficacy among patients with cardiovascular diseases: a meta-analysis"; B. Basinska (Gdansk University of Technology) - „Patterns of job-related affect and

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their relation with burnout syndrome: cross-sectional and longitudinal studies"; E. Gruszczyńska[1], M. Rzeszutek[2], E. Firląg-Burkacka[3] ([1]Psychology Department, SWPS-University of Social Sciences and Humanities in Warsaw, [2]University of Warsaw, [3]Warsaw's Hospital of Infectious Diseases) - „Social support, stress and affect among people with HIV/AIDS: a diary study of buffering hypothesis"; K. Horodyska, M. Boberska, M. Kruk, A. Łuszczyńska (Psychology Department, SWPS-University of Social Sciences and Humanities in Wrocław) - „Parental and child perception of environment on physical activity and BMI. Longitudinal dyadic study"; A. Kroemeke[1], Z. Kwissa-Gajewska[1], M. Sobczyk-Kruszelnicka[2]([1]Psychology Department, Warsaw School of Social Sciences and Humanities, Maria Skłodowska-Curie Memorial Cancer Center-Institute of Oncology in Gliwice) - "Effects of daily coping on mood in couples dealing with hematopoietic stem cell transplantation"; A. Łuszczyńska, K. Horodyska, M. Boberska, M. Kruk (Faculty of Psychology, SWPS-University of Humanities and Social Sciences in Wrocław) - "Why are you eating, moment? Mothers' emotional, restrained, and external eating explaining children's eating styles"; M.M. Małkiewicz (Psychology Institute, Cardina Stefan Wyszyński University in Warsaw) - „Can the experience of hope increase the propensity to cope actively in a stressful situation?"; D. Molek-Winiarska (Wroclaw University of Economics) - "The use of psychological training in stress management intervention for extractive sector employees"; E.Wilczek-Rużyczka (Cracow University A.F. Modrzewski) – "Job burnout and empathy in physicians and nurses"; K. Zarychta[1], M. Kruk[1], C. Chan[2], A. Łuszczyńska[1] ([1]Psychology Department, SWPS-University of Social Sciences and Humanities in Wrocław, [2]Australian Catholic University) - „Health and restrictive eating as mediators between appearance evaluations and BMI reduction in healthy adolescents".

During the first day of the Conference, 15 thematic sessions and 8 symposia were held, covering, among others, occupational health issues, mechanisms and adherence in interventions for patients with chronic diseases, individual differences in coping as well as their impact on health behaviors and the results of interventions, new e-methods in research focusing on pain or how to improve health care service delivery in the health care sector. Moreover, one roundtable discussion took place concerning new methods of teaching health professionals.

A significant event on the first day of the Conference was the speech of Prof. Lucidi, who spoke about the use of doping by teenage athletes. During his speech, he focused mainly on a group of amateur athletes, reflecting on the mechanisms regulating the intentions and use of doping as well as the role that knowledge plays in the preparation of anti-doping intervention programs. Moreover, on the first day there were also presentations by Dr. Zarychta and Banik, MSc, which belong to the research team headed by Prof. Łuszczynska, PhD, as well as a presentation by Basinska, PhD. The first presentation concerned restrictive eating as a mediator of the relation between appearance evaluation and BMI in teenagers. The second was a meta-analysis of the relationship between health-related quality of life and self-efficacy in cardiovascular patients. The third presentation concerned the identification of affective patterns and their relationship with professional burnout.

During the second day of the Conference there were 12 thematic panels, 8 symposia and one roundtable discussion. Researchers discussed, among others, eating disorders and smarthphone app-based interventions, stress and coping with it within a family, pain control, interventions used in chronic diseases, or new theoretical models of job demands. The main speaker on that day was Prof. Pagoto, who spoke about the role of "social media" in research and promotion of health-promoting behaviors. Moreover, in one of the thematic panels, Dr. Molek-Winiarska presented the results of research on the effectiveness of reducing occupational stress in copper mine employees. Whereas, in another thematic panel, Prof. Wilczek-Rużyczka talked about professional burnout and doctors and nurses' sense of empathy.

During the next day of the conference, 16 thematic panels, 6 symposia and two discussions were held. The topics discussed mainly concerned the determinants of wellbeing and predictions of behavior and health in various social groups. Again, the effects of using new technologies in health promotion and in crisis intervention were discussed, in several panels. One of the thematic panels also concerned the cognitive and physical functioning of older people. The main speaker on that day was Prof. O'Connor, who gave a presentation on the model of explaining the implementation of suicidal behaviors.

During the third day of the Conference, a presentation on the perception of physical activity by the parent and her relationship with BMI of the child was also given by Horodyska, MSc, a member of the research team of Prof. Łuszczynska. Whereas, Prof. Łuszczyńska presented the results of research on the maternal eating style and its

relation to the eating style of overweight children. Moreover, during another thematic session, Dr. Małkiewicz presented the results of research on the role of experiencing hope emotions in active stress management.

During the last day of the conference there were 5 thematic panels and 3 symposia. Issues were raised in relation to: social support, functioning after transplantations, using qualitative methods in the evaluation of interventions related to behavioral change. The main speaker was Prof. Anmarie Cano with a presentation on how to support people with chronic pain and their relatives. Prof. Cano encouraged to consider whether, in fact, any behavior of the patient that results from chronically experienced pain should be extinguished. At the end of her presentation, she shared her own experience of using mindfulness and acceptance strategies in working with couples in which one person is experiencing chronic pain. Additionally, during the last day of the conference, the results of the research were presented by Dr. Kroemeke and Dr. Gruszczyńska. Dr. Kroemeke's speech concerned the impact of daily stress management on the emotional state of patients after haematopoietic stem cell transplantation (HSCT) and their partners. In turn, Dr. Gruszczyńska referred to the results of the study concerning the impact of social support on the relationship between daily stress and the affective state of people living with HIV/AIDS experienced at the end of the day.

Summarizing this year's EHPS Conference, it is worth adding that apart from lectures, thematic sessions and discussions, there were also 7 workshops improving practical skills of providing psychological support and psychotherapeutic work, as well as improving knowledge and skills of statistical data analysis, and writing scientific articles. Moreover, during the last day an announcement was made that next year's EHPS Conference will take place in Galoway, Ireland.

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Standard journal article

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Article with published erratum

Koffler D, Reidenberg MM. Antibodies to nuclear antigens in patients treated with procainamide or acetylprocainamide [published erratum appears in N Engl J Med 1979;302:322-5]. N Engl J Med 1979; 301:1382-5.

Article in electronic form

Drayer DE, Koffler D. Factors in the emergence of infectious diseases. Emerg Infect Dis [serial online] 1995 Jan-Mar [cited 1996 Jun 5];1(1):[24 screens]. Retrieved 25 January 2013 from: http://www.cdc.gov/ncidod/EID/eid.htm.

Electronic resource

Health on the net foundattion code of conduct (HONcode) for medical and health websites. 1997; Retrieved 9 January 2013 from https://www.hon.ch/HONcode

Article, no author given

Cancer in South Africa [editorial]. S Afr Med J 1994;84:15.

Book, personal author(s)

Lazarus RS, Folkman S. Stress, appraisal and coping. New York: Springer Publishing Co.; 1984.

Book, editor(s) as author

Norman IJ, Redfern SJ, eds. Mental health care for elderly people. New York: Churchill Livingstone; 1996.

Book, Organization as author and publisher:

Institute of Medicine (US). Looking at the future of the Medicaid program. Washington: The Institute; 1992.

Chapter in a book

Charzewska J, Wajszczyk B, Chabrom E, Rogalska-Niedźwiedź M. Aktywność fizyczna w Polsce w rożnych grupach według wieku i płci. In: Jarosz M, ed. Otyłość, żywienie, aktywność fizyczna i zdrowie Polaków. Warszawa: Instytut Żywności i Żywienia; 2006:317-339.

Conference proceedings

Kimura J, Shibasaki H, eds. Recent advances in clinical neurophysiology. Proceedings of the 10th International Congress of EMG and Clinical Neurophysiology; 1995 Oct 15-19; Kyoto, Japan. Amsterdam: Elsevier; 1996.

Conference paper

Bengtsson S, Solheim BG. Enforcement of data protection, privacy and security in medical informatics. In: Lun KC, Degoulet P, Piemme TE, Rienhoff O, eds. MEDINFO 92. Proceedings of the 7th World Congress on Medical Informatics; 1992 Sep 6-10; Geneva, Switzerland.

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